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THE EFFECT OF OXYGEN INJECTION ON THE COURSE AND PROGNOSIS OF DIPHOSGENE POISONING

V. G. Motylev
Toxicology Faculty
Naval Medical Academy

In spite of the extensive experimental and clinical research, there is yet no agreement as to the effectiveness of subcutaneous injections of oxygen against diphosgene poisoning. On the one hand we have the protagonists, Mel'khior, Fishenzon, Dragov and Glebovich, Seemovik, and others, and on the other the opponents of the method who disclaim effectiveness against anoxemic conditions and, in particular, against poisoning by war gases, (Archard and Binet, Fegler and Bartenbach and others. Mitsev found, using both healthy and acute emphysematous dogs, that subcutaneous injections of oxygen were ineffective against anoxemia. The changes in the respiratory condition were not constant; in some cases, respiration was slow and deep, while in others faster and shallow. The blood pressure curve gives a clearer picture, indicating a decrease in the pulse rate and increase in pulse amplitude. The maximum and minimum pressure either increased or remained unchanged. Among the animals poisoned with diphosgene, some subcutaneous injection of oxygen produced increase in the oxygen content in the arterial blood in 40 percent and in the venous blood in 26.1 percent. However, the increase did not exceed 1 - 2 percent and for this reason was of no practical value. This increase of oxygen in the blood is caused by the reflex action of the subcutaneously injected oxygen on respiration.

The purpose of this research is to trace the effect of subcutaneously injected oxygen on the course of diphosgene poisoning in test animals (cats). These animals were poisoned with close to the minimum lethal dose of diphosgene after which one group of animals were subcutaneously injected with oxygen and the other group kept as control. The subcutaneous injection of oxygen was accomplished by means of two Bohrov apparatus coupled together, one containing oxygen and the other water for oxygen displacement. The amount of oxygen injected was determined by the amount of water forced into the first vessel. Since the introducing of a needle into the skin seemed to be a possible factor in affecting the condition of the animals, the control animals were also subjected to a needle prick. Both groups of animals were systematically examined (respiration, pulse, temperature, hemoglobin, speed of oxygen resorption).

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In all, seven tests were carried out on 53 animals; 27 cats were subcutaneously injected with oxygen, while 26 were kept as control. The results of these tests are given in the appended table.

Out of the 27 cats that were subcutaneously injected with oxygen, 22 died (80 percent), whereas out of the 26 control animals, 15 died (58 percent). Discounting the treated cats, which died of subacute pneumonia, we find that 20 animals of this group died of acute emphysema. The survival periods show that during the first 8 hours the fatalities among the control and treated cats were almost identical. Most of the treated animals and all of the control animals died during the following 2 days. Of the treated cats, four died 3 - 7 days later, i. e., after the control cats had died.

To clarify the effect of subcutaneous oxygen injections on the extent of emphysema in the dead animals, the pulmonary coefficient, specific gravity of the lungs, and the cardio-pulmonary coefficient, (weight of lungs per gram of heart) were determined by autopsy. Analysis of the results shows no essential difference in these coefficients in the test and control animals. For example, the pulmonary coefficient of the treated animals which died within 10 hours after poisoning was 30 - 33 and 29 to 32 for the control animals. The corresponding specific gravity for the lungs were 0.6 - 0.62 and .63 - 0.68. Similar results were obtained from other survival periods for the test and control animals. On the basis of this data we conclude that oxygen injection has no noticeable effect even on the course of toxic emphysema. This was confirmed by data on the changes in the hemoglobin estimate which was almost identical in both the control and test animals.

We detected a difference only in the condition of the pulse and respiration between the test and control animals: the prolonged and well defined bradycardia and increased respiration rate were more pronounced in the treated cats.

There was a definite difference in the resorption of the subcutaneously injected oxygen in each of the animals. A comparatively small number of the treated cats resorbed the gas from subcutaneous tissues more rapidly than the others. The general condition of these particular animals seemed to be considerably better and the pulse and respiratory abnormalities were also less marked. However, in the final stage, this condition had no effect on the outcome of the poisoning in the final stage and therefore does not warrant considering oxygen therapy valuable.

The slightly higher mortality rate among the treated animals enables one to suppose that subcutaneous injection of oxygen does not preclude the possibility of the mechanical irritation in subjecting the test animal to excessive physical strain. On the other hand, one cannot rule out the possible influence of chemical or physicochemical factors (Weichardt).

On the strength of the above results, we can consider that subcutaneous injection of oxygen does not produce a beneficial effect on the prognosis and course of toxic emphysema. Yet, again, doubt is cast on the viewpoint of certain authors (Fisherzon) who consider subcutaneous injection of oxygen a supplementary vicarious subcutaneous respiration.

Conclusions

1. Subcutaneous oxygen injections in cats poisoned with diphosgene are not beneficial.

2. Subcutaneous oxygen injections have no effect on the dynamics of toxic emphysema in cats poisoned with diphosgene.

3. The only beneficial effect of subcutaneous oxygen injections on cats poisoned with diphosgene is observed in the pulse (equalization of subnormal pulse) and respiration. However, this beneficial effect has no actual influence on the prognosis.

4. The speed with which oxygen is resolved from subcutaneous cellular tissue in cats poisoned with diphosgene does not correspond to the degree of anoxemia and evidently depends on the individual peculiarities of the test animals.

SURVIVAL TIME OF TEST ANIMALS (CATS) POISONED WITH DIPHOSGENE AND TREATED WITH SUBCUTANEOUS INJECTION OF OXYGEN

Test	Concentration of Diphosgene (mg/l)	No of Test Animals: Treated	Control	No of Dead Treated Animals: First 8 Hr.	8 - 18 Hr.	After 1 day	After 2 days	After 3 days	After 4 days	After 7 days	Total
1	0.2	4	4	-	-	-	-	1	-	1	2
2	0.29	2	2	-	1	1	-	-	-	-	2
3	0.23	2	2	-	-	-	-	-	1	-	1
4	0.24	4	4	1	2	-	-	-	1	-	4
5	0.342	3	3	-	2	1	-	-	-	-	3
6	0.26	6	5	2	2	-	-	-	-	-	4
7	0.293	6	6	3	3	-	-	-	-	-	6
Total		27	26	6	10	2	-	1	2	1	22
Mortality (%)		-	-	22	36	7	-	4	7	4	80

Test	Concentration of Diphosgene (mg/l)	No of Test Animals: Treated	Control	No of Dead Control Animals: First 8 Hr.	8 - 18 Hr.	After 1 day	After 2 days	After 3 days	After 4 days	After 7 days	Total
1	0.2	4	4	1	1	-	-	-	-	-	2
2	0.29	2	2	-	-	1	1	-	-	-	2
3	0.23	2	2	-	-	-	-	-	-	-	-
4	0.24	4	4	1	-	-	1	-	-	-	2
5	0.342	3	3	-	-	-	1	-	-	-	1
6	0.26	6	5	1	3	-	-	-	-	-	4
7	0.293	6	6	2	2	-	-	-	-	-	4
Total		27	26	5	6	1	3	-	-	-	15
Mortality (%)		-	-	19	23	4	12	-	-	-	58

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